2006-07 RUFFED GROUSE POPULATION STATUS IN VIRGINIA

by

GARY W. NORMAN

Virginia Department of Game & Inland Fisheries
P.O. Box 996
Verona, Virginia 24482

Abstract: Two spring drumming surveys and two fall hunter surveys were conducted to monitor ruffed grouse population status in Virginia. Spring 2006 breeding populations were below-average based on drumming indices from roadside and spring gobbler hunter surveys. Fall 2006-07 population levels were also below-average based on flushing rates from grouse hunters and observations of grouse by bow hunters. Cooperating grouse hunters reported 1.01 grouse flushed per hour during the 2006-07 hunting season. This flushing rate represented an increase over 2005-06 and similar increases were also seen in throughout the Mid-Atlantic region. In contrast to the higher number of grouse flushed by grouse hunters, archers saw fewer grouse while bow hunting for deer in October. Recruitment was above-average based on the percentage of juveniles harvested by grouse hunters, but observations of grouse broods by field personnel declined in 2006. Grouse hunter satisfaction ratings for the 2006-07 season were identical (3.0 on scale of 1-7) to last year. Overall there was little change in grouse population levels in Virginia during 2006-07. The spring 2007 breeding population remained at low levels. Trend analyses suggest significant annual declines in grouse breeding population levels based on drumming indices from roadside surveys (-2.5%) and spring gobbler hunter surveys (-2.4%) in Virginia over the past 14-15 years.

Ruffed grouse (*Bonasa umbellus*) population management is the responsibility of the Virginia Department of Game and Inland Fisheries (VDGIF). The VDGIF seeks to maintain grouse populations at levels that provide quality hunting and nonconsumptive opportunities in Virginia's occupied grouse range. The ruffed grouse is a popular game bird in Virginia. Approximately 11,735 hunters hunted 48,147 days to harvest 14,081 grouse during the 2005-06 season (Jagnow and Steffen 2006). Grouse harvests are regulated by adjusting season lengths and bag limits, and annual surveys of grouse populations and harvests are used to help evaluate the status of ruffed grouse in Virginia.

The Department would like to thank the individuals who cooperated with ruffed grouse and spring gobbler surveys. Appreciation is extended for their time and effort to provide valuable information for ruffed grouse management in Virginia. We would also like to thank personnel of VDGIF and U.S. Forest Service (USFS) for their assistance with the roadside drumming surveys and brood reports. Special thanks are given to Mr. J. W. Coleman and H. R. Mobley for volunteering their time to assist with the drumming survey. Cale Godfrey and Galon Hall provided critical reviews and improved this report.

METHODS

Grouse Hunter Survey

A non-random volunteer group of cooperating hunters (cooperators) were included in the 2006-07 survey. Cooperators have been solicited from VDGIF quail and woodcock survey cooperators, Virginia members of the Ruffed Grouse Society and Quail Unlimited, popular articles, and press releases.

Data sheets and wing envelopes were provided to cooperators (Appendix A). Cooperators were asked to report the number of hours they hunted, grouse flushed, and grouse killed by county and land ownership types. Cooperators were also asked to

rate individual hunt quality on a scale from 1 (poor) to a high of 7 (excellent).

To determine sex and age related information on the grouse population, cooperators were asked to provide tail and wing feather samples from any birds they harvested. Age (juvenile or adult) was determined by examining the curvature of the tenth primary, the presence or absence of sheathing, and the length of the 9th primary (Davis 1969). Where equivocal age determinations were noted, curvature of the wing tip and feather sheathing were considered the most reliable techniques. Sex was determined by examining the length of plucked mid-rectrix feathers (Davis 1969). Chi-square analyses were used to compare age and sex frequency distributions by month of the season and by region (Fig. 1, 2) of the state.

Grouse hunter flushing and harvest rate information were used as indices to fall population density and trends. Information on age distribution from hunter-collected feather samples was used as an index to annual recruitment.

Grouse hunting season dates were 28 October 2006 to 10 February 2007. The bag limit was 3 per day. The season was closed in counties east of Interstate 95.

October Bow Hunter Survey

A non-random volunteer group of archery hunters reported grouse observations while hunting deer in October. Participating archers provide information on grouse seen, hours hunted, and the county hunted (Fies and Norman 2005).

Spring Gobbler Hunter Survey

During Virginia's spring gobbler season, a non-random volunteer group of hunters, primarily National Wild Turkey Federation members, provided information on the county hunted, number of hours hunted, number of grouse heard drumming, and number of grouse flushed (Norman 2005). Drumming (grouse/hunt) rates were used as indices to spring grouse population densities and trends. Drumming analyses were based on the first 2-weeks of the spring gobbler season when drumming rates were highest. Overall means and estimates were calculated as linear functions of annual estimates.

Roadside Drumming Survey

Survey routes (n = 52) within Virginia's occupied grouse range were randomly chosen using 7.5 minute topographic maps. Routes began at the intersection of secondary roads nearest the center of selected topographic maps. A random direction of travel was assigned to the starting point and at subsequent road intersections. Routes were at least 10 miles in length with 10 listening stops at 1-mile intervals. Routes were longer if hazardous road conditions were found within 100' of the 1-mile odometer reading. Each route was surveyed twice, once during the 2nd and 3rd weeks of April. The survey began 30 minutes before sunrise. Observers recorded the number of drums during a 4-minute listening period. Disturbance was recorded (Appendix B). Stops with high disturbance were censored. Personnel of the VDGIF, USFS, and volunteers conducted the surveys. Overall means and estimates were calculated as linear functions of annual estimates.

Breeding Population Trend Analysis

Population trends were based on the percent change in numbers of drums heard and numbers of drumming grouse heard in the roadside drumming survey and spring gobbler hunter survey. Drumming data over the period were analyzed with a multiplicative model using a log transformation and linear regression (Sauer and Geissler 1990):

$$y = ab^{x}e$$

where, y = number of drums per stop or number of drumming grouse per hunt, x = year, a = intercept, b = trend, and e = error term. Logarithms were used to make the model a linear regression: $\ln(y + 0.05) = \ln(a) + \ln(b)\, x + \ln(e)$. The slope of the linear regression, ln (b), was back–transformed to estimate b (Bradu and Mundlak 1970) where,

$$b = e^{[\ln(b) - 0.5\mathrm{var}\{\ln(b)\}]}.$$

The percent change per year was 100(b-1). Trends were considered significant if the regression was significant (P<0.05).

Brood Observation Survey

From May to September, VDGIF and USFS personnel reported ancillary grouse observations during normal work activities. Personnel reported numbers of adult and young grouse seen. Brood observations were used as indices of hen success and

chick survival.

RESULTS

Population Trends and Densities

Spring 2006. Roadside drumming survey observers heard a total of 66 drums during 93 routes with 861 acceptable stops. The mean number of drums heard per route in 2006 was 0.8 (Table 1). The 2006 roadside drumming rate was below the long-term survey average (1.2 drums/route).

Cooperating spring gobbler hunters reported hearing 264 drummers and flushing 95 ruffed grouse during 1,355 hunts in Virginia's primary grouse range. Cooperators heard a rate of 0.42 drumming grouse/hunt and they flushed 0.11 birds/hunt during the survey period (Table 1). The 2006 drumming rate was below the survey average of 0.62 drumming grouse/hunt. The Central Region was the only region to show a significant increase in drumming rates in 2006. Drumming rates were comparable across regions (Table 1, Fig. 2).

Fall-Winter 2006-07. Cooperating grouse hunters (n=54) reported data from 830 hunts. Cooperators averaged hunting 15.4 days during the season (Table 2). An average hunt lasted 3.4 hours (Table 2). Hunters reported flushing 2,802 birds while hunting 2,783 hours (Table 3). Flushing rates were comparable throughout the months of the season (Table 3). Throughout the season hunters averaged flushing 1.01 grouse per hour, which is lower than the long-term average of 1.15. The 2006-07 flushing rate was considerably less than the 2001-02 season where a record flushing rate (1.61 grouse/hr) was reported. The lowest flushing rate occurred in 1976-77 (0.72 grouse/hr). Flushing rates increased modestly in 2006-07 in most states in the Mid-Atlantic region. Flushing rates from most states over the past several years have been below 2001 levels (Fig. 5).

Cooperators harvested 317 grouse or 5.9 grouse per cooperator last season. On average, 8.8 hours of hunting was required to harvest a grouse. Little difference in harvest rates (kill/hr) was found in months of the season (Table 3).

Cooperators in the Southern Region of Virginia's grouse range have typically reported higher flushing rates than cooperators in the Northern Region (Table 6, Fig. 1). During the 2006–07 season flushing rates in Southern Region (1.26 grouse/hr) continued to exceed flushing rates in the Northern Region (0.81 grouse/hr). Harvest rates were also higher (0.14 grouse/hr) in the Southern Region than the Northern Region (0.09 grouse/hr). Quality indices were 3.3 for Southern Region hunters compared to 2.8 for Northern counterparts.

Bow hunters (n=299) reported seeing 117 grouse on 3,757 bow hunts in the 2006 early archery season. In counties west of the Blue Ridge Mountains archers reported seeing 1.8 grouse per 100 hours of hunting. Archers reported seeing a high of 5.2 grouse per 100 hours in the 1997 season. The grouse observation rate in 2006 was the lowest recorded in the survey history (Fig. 3).

Spring 2007. Drumming survey observers heard a total of 60 drums during 81 routes with at 815 acceptable stops. The mean number of drums heard per route was 0.7 (Table 1). The 2007 data suggests little change in spring breeding populations. The 2007 roadside drumming rate was the lowest rate observed during the 14-year history of the survey. The highest total number of drums heard was 189 in the 2001 survey.

Cooperating spring gobbler hunters reported hearing and flushing fewer grouse while turkey hunting in 2007 (Table 1). Both 2007 spring surveys (roadside and spring gobbler hunters) suggest that breeding populations were below average.

Long-Term Trends. Trend analyses of the roadside drumming data suggest that breeding population levels have declined 2.5% annually over the past 14 years (P = 0.001). Trend data (Fig. 3) from the spring gobbler hunter survey suggested a 2.4% annual decline over the past 15 years (P < 0.001).

Recruitment

Cooperators submitted 208 usable wings for age and sex determination. Juvenile birds comprised 47% of the sample with a ratio of 1.7 juvenile birds per adult female (Table 5). The 2006–07 recruitment index of juvenile birds in the harvest was higher than the long-term average (41%).

Juveniles normally comprise a large percentage of the harvest in the early months of the season and adults typically comprise the majority of the harvest at the end of the season. This pattern was suggested in the 2006-07 season as juveniles comprised more of the early season harvest (Table 5). October was

discounted from this examination because of the low sample size (n = 6). Age ratios were significantly different by month (X^2 = 9.7, df = 4, P = 0.05). Age ratio differences were also found between the regions as juveniles comprised 57% of the Northern Region and 39% of the Southern Region harvest (X^2 = 5.4, df = 1, P = 0.02).

Males comprised 46% of the harvest (Table 4). Harvest sex ratios were not different (X^2 = 5.5, df = 4, P = 0.24) by month (Table 5) of the season or between regions (X^2 = 1.72,df = 1, P = 0.19; Table 6).

The total number of grouse seen (n = 68) by personnel during the spring and summer months in 2006 was the lowest reported in the survey history. The number of observers declined in 2006 and may have contributed to the decline in total number of grouse seen. However, the number of young per brood was the lowest reported during the survey history (2.7 young/adult female). The long-term average was 4.0 young per adult female.

Although males would be included as single adults, the observed ratio of successful hens to total adults observed may be a useful index to the percentage of hens that successfully hatch clutches. To be useful as a trend index, the observation probability for males and females (both successful and unsuccessful) must be consistent over time. This index indicated female success (77%) was above the long-term average (62%) in 2006 (Table 7).

Hunters and Hunter Satisfactions

The average quality of hunt rating for cooperating grouse hunters was 3.0 during the 2006-07 season. The 2006-07 quality rating was comparable to 2005-06 and was marginally better than the 2003-04 season where satisfaction ratings were 2.7 (Table 2). Cooperators' ratings of hunting quality were variable among the months of the season (Table 3).

Cooperators hunting on state-owned lands reported higher flushing rates (1.6) than cooperators hunting on private (1.1) or federal-owned (0.9) lands. Hunt quality ratings were higher on state-owned lands (4.1) than private (3.4) or federal lands (2.9).

Cooperators hunting with dogs reported higher flushing rates (1.05 flushes/hr) and harvest rates (0.12 grouse/hr) than those hunting without dogs (0.46 flushes/hr, 0.01 grouse/hr; Table 8). Although they flushed fewer and killed fewer birds, hunter satisfactions were higher among those hunters who did not use a dog (Table 8).

DISCUSSION AND SUMMARY

Data from roadside and spring gobbler hunter surveys suggest breeding populations of ruffed grouse stabilized at low numbers in the spring of 2006. Grouse recruitment in the summer of 2006 indicated relatively high hen success but below average chick survival. From the hunter's bag, it appeared recruitment was good in 2006 as the percentage of juveniles harvested was above average. Likewise, grouse hunters reported flushing slightly more birds per hour in 2006-07 than in 2005-06. These grouse hunter survey data appear to indicate increased fall grouse populations. However, grouse observations by archery deer hunters during October 2006 were the lowest ever reported in the bow hunter survey. Additionally, spring breeding population levels based on roadside and spring gobbler hunter survey data suggest further declines in the spring breeding population of grouse in Virginia.

While it is clear that grouse populations levels in Virginia have declined over the past 5 to 10 years, determining the current status in the population is equivocal as different monitoring techniques suggest different trends. The most promising data come from the grouse hunter survey. This survey suggests good recruitment and increased fall population levels in 2006. However, the number of cooperating grouse hunters has declined over the past several years. It is possible that increased flushing rates could be an artifact of the sample size of cooperators. As the number of grouse hunters in the survey declines, those that are left may be the most avid and ardent hunters. These "hard-core" grouse hunters may be more successful or have better habitats to hunt, therefore elevating flushing rates. However, higher flushing rates were also seen in other Mid-Atlantic States suggested a region-wide increase in grouse populations. These results are encouraging for grouse enthusiasts.

On the other hand, recruitment data, brood reports, archery hunters, and spring drumming surveys indicate declining grouse populations.

Field personnel saw fewer grouse broods during the summer of 2006, and the number of young grouse seen per brood was below average. The number of grouse seen by personnel in 2006 was at an all-time low; however, the low numbers could be due, in part, to a loss of field personnel. The loss of field personnel would help explain the lower total numbers of grouse seen, but it would not explain the low number of chicks per brood. This low ratio suggests low survival rates of young birds in 2006. Poor recruitment was also suggested by cooperating archers who saw fewer grouse per hour of bow hunting during October 2006. The bow hunter survey was our largest survey in terms of sample size and hours of observation, so we place significant weight on these results. Poor recruitment and a downward trend in fall populations were supported further by low numbers of drummers heard in the 2007 spring surveys. However, adult birds do most of the drumming, and the number of drummers may not reflect total spring population if good recruitment occurred in the previous year because juveniles require 2 years to reach breeding status. Therefore, a 2-year lag effect may occur in spring drumming surveys, and the possibility of good recruitment in 2006 may not be indicated in spring drumming surveys until 2008.

When survey data agree it is easier to determine population status and forecast population trends. However, when surveys provide equivocal results confidence in determining population status and trends is diminished and evaluation becomes less certain. Interpreting equivocal survey results in 2006-07 was challenging and difficult. Declining sample sizes of cooperating grouse hunters and field personnel contribute variation into the interpretation of survey results. Ideally, sample sizes and effort should be high with the same cooperators from year to year.

In conclusion, the 2006-07 season provided some glimmer of hope that fall grouse populations held their own in Virginia and the Mid-Atlantic region. However relative to 5 or 10 years ago, there is reason for concern about the status of grouse because of declining long-term trends in breeding population levels.

The cause of the decline in grouse numbers is unknown. Early successional habitat has declined on most public lands, particularly on Virginia's National Forests. Grouse population trends may reach some low equilibrium in the future unless habitat conditions improve. Time will tell if we're near that point or if the grouse population will decline even more. Further compounding the loss of habitat has been several years of poor mast or mast failures during the past 5 years. Department research indicates grouse reproduction is closely tied to the condition of adult females. Acorns are a preferred food rich in fat and energy. During years of good acorn production, grouse body fat levels generally increase. Higher body fat levels are believed to improve grouse fitness as they move less for food, have smaller home ranges, and have reduced vulnerability to predation. The availability of early successional habitats and acorn production are likely to be significant factors regulating grouse populations in the Appalachians.

While the trend in grouse populations is not encouraging, findings of the Appalachian Cooperative Grouse Research Project (ACGRP) indicate the creation of additional habitats using clear cuts or shelterwood cuts may help stabilize or increase local grouse populations. Results of the ACGRP can be found on the Department's web site (www.dgif.virginia.gov). The study found no effects of hunting on grouse populations in the region at current harvest levels. It is apparent however that the declines seen in Virginia's grouse populations are also being seen in other states in the region (Fig. 5).

The George Washington National Forest is currently undergoing a review of its management plan. The Department is encouraging the creation of additional early successional habitats to benefit grouse and other wildlife species with similar needs. We urge hunters to become involved in the planning process and express their opinions about management of the George Washington National Forest. The James River Ranger District deserves credit for their efforts to create more habitat for grouse and other wildlife that need young forests.

Hunting ruffed grouse in the southern Appalachians is a challenging sport as evidenced by the return of 1 grouse for every 9 hours of hunting. It nevertheless can be very enjoyable, particularly on those days when the dogs work well, the birds hold tight, and your aim is true. Thanks again to those dedicated hunters that contribute to these Department surveys and still enjoy the often demanding world of grouse

hunting the Appalachians.

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Table 1. Mean drumming rates (±SE) of ruffed grouse reported by spring gobbler survey hunters (drumming grouse/hunt) and the roadside drumming survey (drumming grouse/route stop) in Virginia.

	Spring Gobbler Survey				Roadside Survey
Year	Southwest	Central	North	State	State
1994	0.54±0.06 (343)	0.60±0.04 (472)	0.71±0.10 (130)	0.59±0.03 (945)	1.4 ± 0.2 (93)
1995	0.62±0.05 (483)	0.62±0.04 (558)	1.11±0.12 (159)	0.69±0.03 (1,200)	1.1 ±0.2 (96)
1996	0.60±0.04 (556)	0.69±0.06 (590)	0.87±0.09 (182)	0.67±0.03 (1,328)	1.7 ±0.3 (98)
1997	0.65±0.05 (497)	0.69±0.05 (519)	0.92±0.08 (263)	0.72±0.03 (1,279)	1.5 ± 0.3 (98)
1998	0.61±0.04 (494)	0.50±0.04 (531)	0.62±0.06 (245)	0.57±0.03 (1,270)	1.2 ± 0.2 (95)
1999	0.58±0.05 (520)	0.48±0.03 (634)	0.71±0.06 (289)	0.56±0.03 (1,443)	1.4 ± 0.2 (87)
2000	0.63±0.06 (446)	0.67±0.05 (523)	0.57±0.06 (272)	0.64±0.03 (1,241)	1.4 ± 0.2 (89)
2001	0.71±0.05 (533)	0.72±0.05 (559)	0.64±0.07 (279)	0.70±0.03 (1,371)	1.9± 0.3 (90)
2002	0.62 ±0.05 (520)	0.72±0.05 (494)	0.37±0.05 (279)	0.60±0.03 (1,293)	1.5 ± 0.2 (97)
2003	0.52±0.05 (450)	0.51±0.05 (420)	0.41±0.06 (264)	0.49±0.03 (1,134)	1.0 ± 0.1 (91)
2004	0.45±0.04 (473)	0.36±0.04 (441)	0.38±0.06 (234)	0.40±0.03 (1,148)	0.9 ± 0.1 (98)
2005	0.53±0.04 (450)	0.35±0.04 (438)	0.44±0.03 (226)	0.39±0.02 (1,114)	0.9 ± 0.2 (88)
2006	0.40±0.03 (529)	0.46±0.04 (539)	0.40±0.13 (285)	0.42±0.03 (1,353)	0.8 ± 0.1 (93)
2007	0.21±0.03 (357)	0.44±0.05 (330)	0.22±0.13 (198)	0.30±0.03 (885)	0.7 ± 0.1 (81)
Average[a]	0.62±0.01	0.62±0.01	0.69±0.02	0.62±0.03	1.2 ± 0.5

[a]Overall means and estimates were calculated as linear functions of annual estimates.

Table 2. Harvest, effort, and satisfaction summary of cooperating ruffed grouse hunters in Virginia.

Year	Coop. (*n*)	Hunts (*n*)	Hunts/ Season	Hours/ Hunt	Grouse/ Season	Kill/ Hour	Flush/ Hour	Hunt Qlty.[1]
1990–91	110	1,241	11.3	4.1	5.5	0.12	1.03	
1991–92	93	1,204	12.9	4.0	5.2	0.10	0.98	
1992–93	81	1,106	13.7	4.0	6.1	0.11	1.01	
1993–94	61	668	11.0	3.6	3.6	0.09	1.10	
1994–95	84	1,040	12.4	3.9	5.3	0.11	0.97	
1995–96	70	780	11.1	3.7	4.8	0.12	1.50	3.2
1996–97	114	1,269	11.1	3.9	5.4	0.13	1.26	3.6
1997–98	87	1,098	12.6	3.7	5.8	0.12	1.33	3.6
1998–99	69	963	13.9	3.3	5.5	0.12	1.11	3.4
1999–00	93	1,013	10.9	3.7	4.5	0.11	1.01	2.8
2000–01	62	904	14.5	3.7	7.9	0.15	1.45	3.6
2001–02	80	1,082	13.5	3.7	8.9	0.18	1.61	4.0
2002–03	64	851	13.3	3.6	6.1	0.13	1.11	3.2
2003–04	60	779	13.0	3.5	4.5	0.10	0.92	2.7
2004–05	94	1,275	13.6	3.3	4.8	0.11	1.03	3.1
2005–06	63	888	13.8	3.3	4.5	0.10	0.85	3.0
2006–07	54	830	15.4	3.4	5.9	0.11	1.01	3.0

Hunt Qlty.[1] = Hunting quality based on a scale of 1 (poor) to 7 (excellent).

Table 3. Monthly harvest, effort, and satisfaction summary of cooperating ruffed grouse hunters in Virginia during the 2006-07 season.

Month	Days Hunted	Hours Hunted	Grouse Flushed	Flush/ Hour	Grouse Killed	Kill/ Hour	Hunt Quality[1]
October	37	134	157	1.17	9	0.07	3.5
November	140	442	485	1.10	44	0.10	3.3
December	251	813	822	1.01	93	0.11	2.8
January	313	1,051	1,022	0.97	136	0.13	3.1
February	88	341	313	0.92	35	0.10	3.0
Season[2]	830	2,783	2,802	1.01	317	0.11	3.0

Hunt Quality[1] = Hunting quality based on a scale of 1 (poor) to 7 (excellent).
Season[2] = Season totals exceeds monthly totals because some hunts without dates were included.

Table 4. Sex ratios, flushing rates, and age distribution of ruffed grouse harvested by cooperating hunters in Virginia.

Season	% Males	% Females	% Juvenile	Flushes/Hour
1973–74	68	32	46	1.31
1974–75	67	33	26	1.00
1975–76	68	32	38	0.98
1976–77	64	36	20	0.72
1977–78	66	34	23	0.90
1978–79	67	33	34	1.21
1979–80	62	38	33	1.21
1980–81	65	35	36	1.44
1981–82	62	38	32	1.36
1982–83	62	38	40	1.57
1983–84	60	40	34	1.17
1984–85	59	41	43	1.17
1985–86	64	36	43	1.18
1986–87	62	38	41	1.40
1987–88	62	38	42	1.19
1988–89	67	33	22	0.83
1989–90	65	35	55	1.05
1990–91	62	38	59	1.03
1991–92[a]	53[a]	47[a]	50	0.98
1992–93	57	43	47	1.01
1993–94	54	46	52	1.10
1994–95	63	37	32	0.97
1995–96	50	50	57	1.50
1996–97	52	48	43	1.26
1997–98	48	52	46	1.33
1998–99	56	44	46	1.11
1999–00	58	42	28	1.02
2000–01	52	48	47	1.45
2001–02	51	49	50	1.61
2002–03	57	43	38	1.11
2003–04	54	46	52	0.92
2004-05	62	38	52	1.03
2005-06	58	42	48	0.85
2006-07	46	54	47	1.01
Average	60	41	41	1.15

[a] Davis (1969) sex criteria adopted.

Table 5. Monthly age and sex composition (%) of ruffed grouse harvested by cooperating hunters during the 2006–07 season. The sample size for these monthly summary statistics were lower than the annual estimates because some samples did not include dates. Therefore, estimates based on the different sample sizes may be slightly different.

	Age		Sex		
Month	Adult	Juvenile	Male	Female	*n*
October	66	33	50	50	6
November	43	57	54	46	35
December	41	58	37	63	51
January	59	41	42	58	85
February	71	28	61	39	28
Season	53	47	46	54	205

Table 6. Age and sex composition of ruffed grouse harvested and flush rates by region.

	Percent Female		Percent Juvenile		Flushing Rate	
Year	North	South	North	South	North	South
1995–96	49	53	62	54	1.47	1.56
1996–97	51	45	38	46	1.17	1.37
1997–98	55	47	45	48	1.29	1.41
1998–99	42	47	44	49	1.06	1.20
1999–00	47	36	28	30	0.95	1.17
2000–01	48	48	43	52	1.36	1.64
2001–02	48	50	50	50	1.61	1.61
2002–03	49	38	33	40	0.85	1.48
2003–04	43	50	46	58	0.76	1.19
2004–05	61	39	64	36	0.84	1.26
2005-06	44	41	56	59	0.69	1.15
2006-07	55	45	57	39	0.81	1.26

Table 7. Grouse brood observations reported by field staff.

Year	Adults[a] *N*	Suc. Fem.[b] *n*	% Suc. Index[c]	Total[d] *n*	$\bar{x}$ Young[e]	Observers *N*
1990	86	61	71	365	4.6	23
1991	92	73	79	364	3.7	26
1992	145	91	63	406	2.9	35
1993	76	42	55	260	4.4	27
1994	149	99	66	572	4.3	30
1995	182	130	71	776	4.6	29
1996	143	59	41	367	3.8	33
1997	144	101	70	576	4.3	37
1998	114	53	46	325	4.0	28
1999	183	127	70	746	4.4	33
2000	116	47	41	341	4.8	53
2001	123	78	63	471	4.5	48
2002	120	91	76	442	3.5	33
2003	50	21	42	138	4.2	30
2004	35	22	63	136	4.6	33
2005	30	16	53	85	3.4	34
2006	22	17	77	68	2.7	28

[a] Adults = count of all adults observed

[b] Suc. Fem. = count of females with young

[c] % Suc. Index = (Suc. Fem./total adults)*100

[d] Total = total adults and young observed

[e] $\bar{x}$ Young = mean number of young per brood

Table 8. Dog use and the success (flush and harvest rates) and satisfaction of cooperating ruffed grouse hunters in Virginia.

	Flushes/Hour		Grouse/Hour		Hunt Quality[1]	
Year	Dogs	No Dogs	Dogs	No Dogs	Dogs	No Dogs
1995–96	1.58	1.38	0.12	0.07	3.6	2.5
1996–97	1.35	0.72	0.14	0.04	3.6	3.8
1997–98	1.41	0.91	0.13	0.08	3.7	4.2
1998–99	1.22	0.71	0.14	0.05	3.5	2.6
1999–00	1.09	0.59	0.11	0.06	2.8	3.4
2000–01	1.56	0.76	0.16	0.05	3.6	3.1
2001–02	1.66	1.26	0.19	0.12	4.0	4.3
2002–03	1.15	0.66	0.13	0.08	3.2	3.6
2003–04	0.98	0.48	0.10	0.04	3.0	2.8
2004-05	1.07	0.61	0.11	0.08	3.0	3.9
2005-06	0.88	0.39	0.10	0.03	3.0	3.1
2006-07	1.05	0.46	0.12	0.01	3.0	3.5

Hunt Quality[1] = Hunt quality based on scale of 1 (poor) to 7 (excellent).

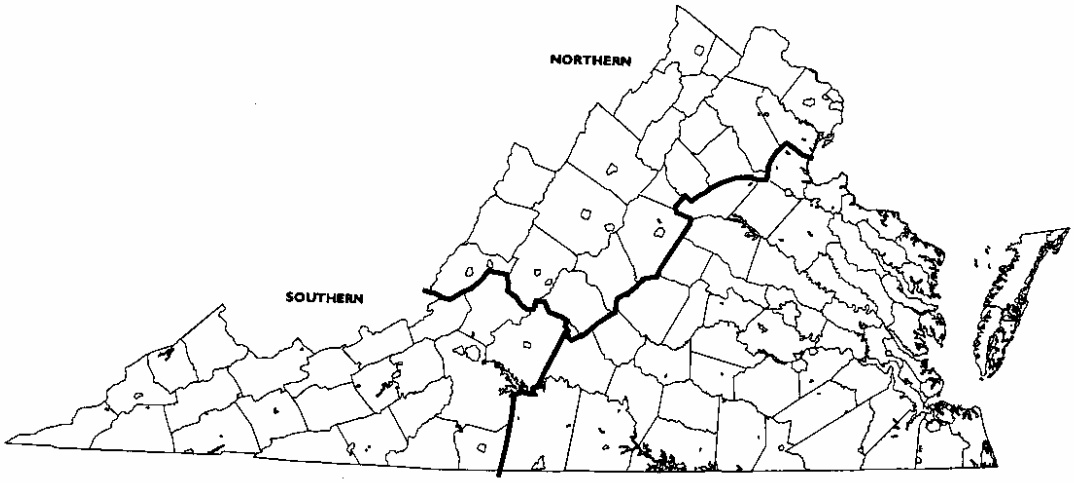

Figure 1. Ruffed grouse regions for fall hunter survey.

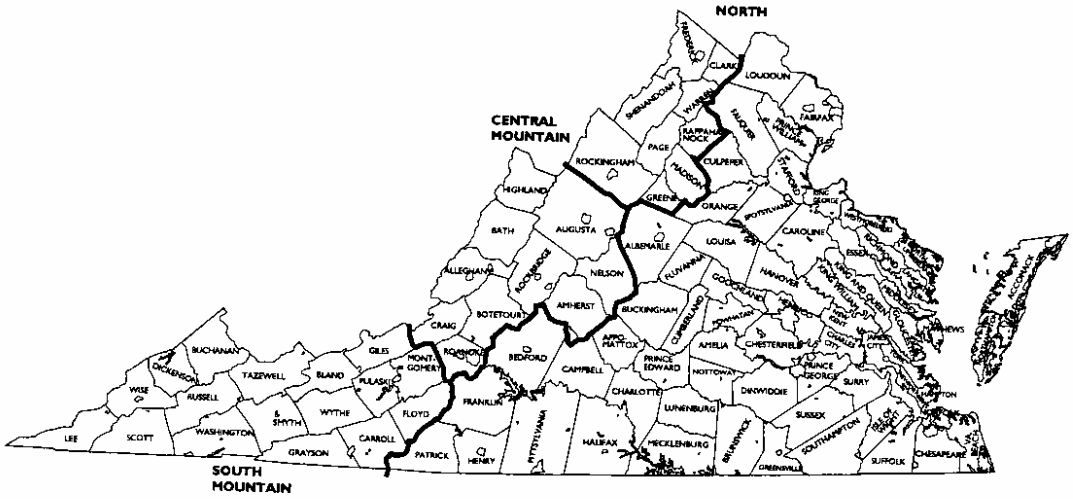

Figure 2. Ruffed grouse regions for spring drumming.

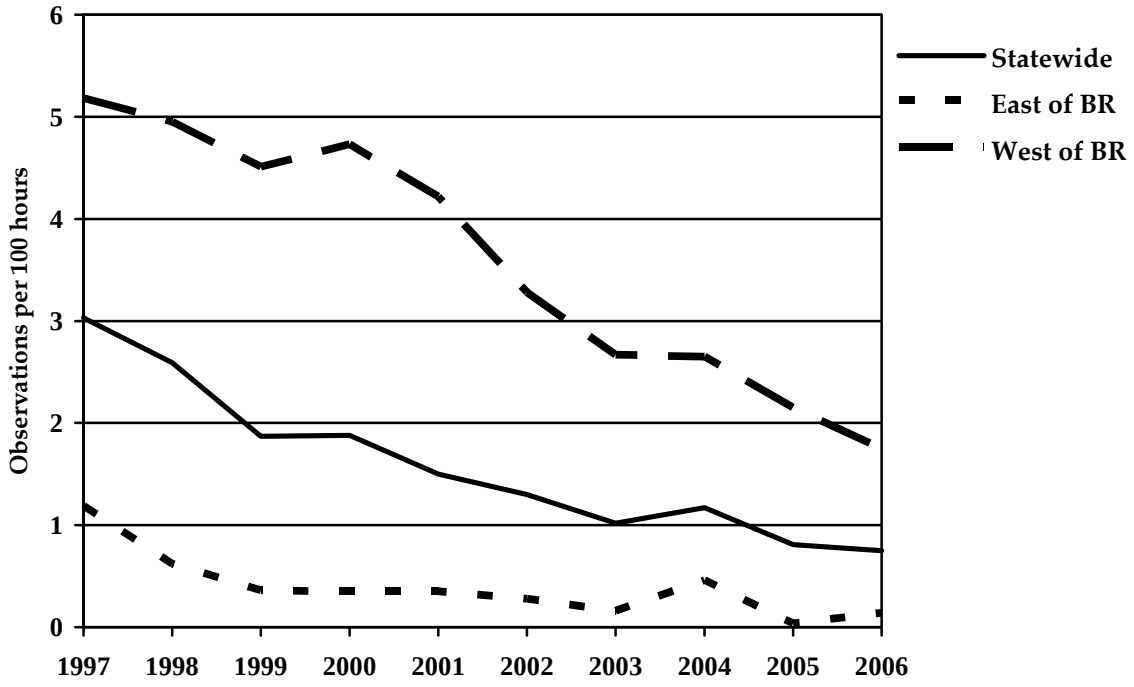

Figure 3. Ruffed grouse observed (per 100 hours of hunting) by cooperating early archery hunters from 1997–2006 east and west of the Blue Ridge Mountains and statewide in Virginia.

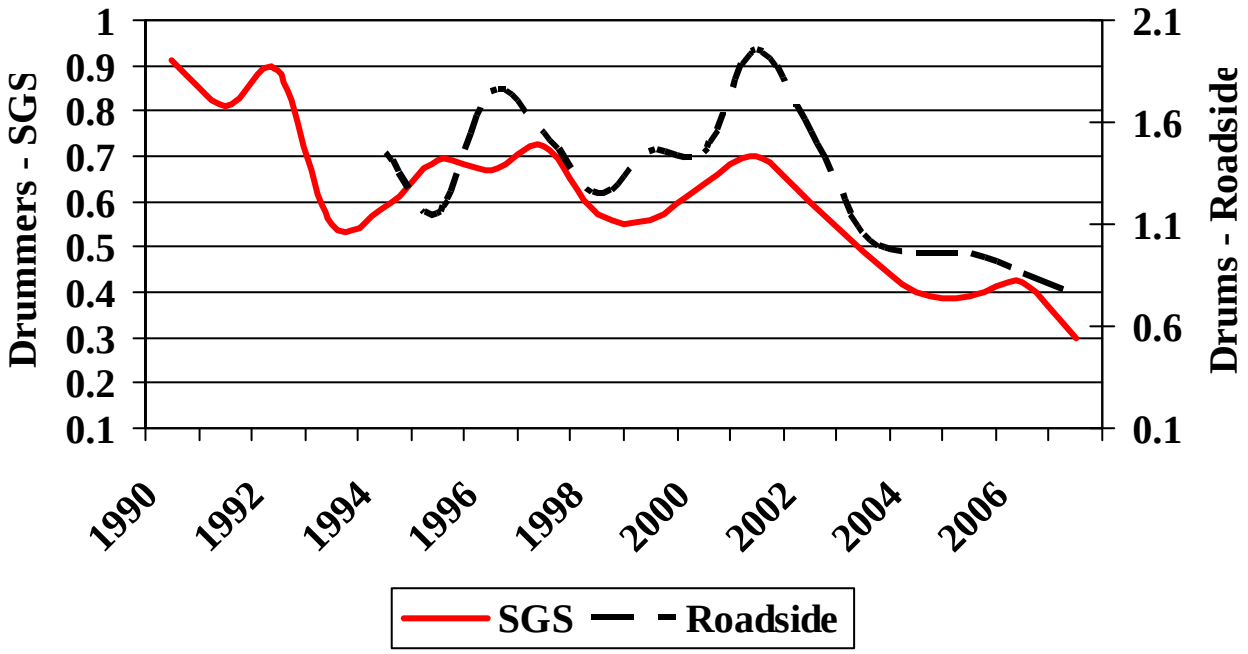

Figure 4. Trends in breeding population indices from spring gobbler hunter surveys and roadside drumming surveys in Virginia.

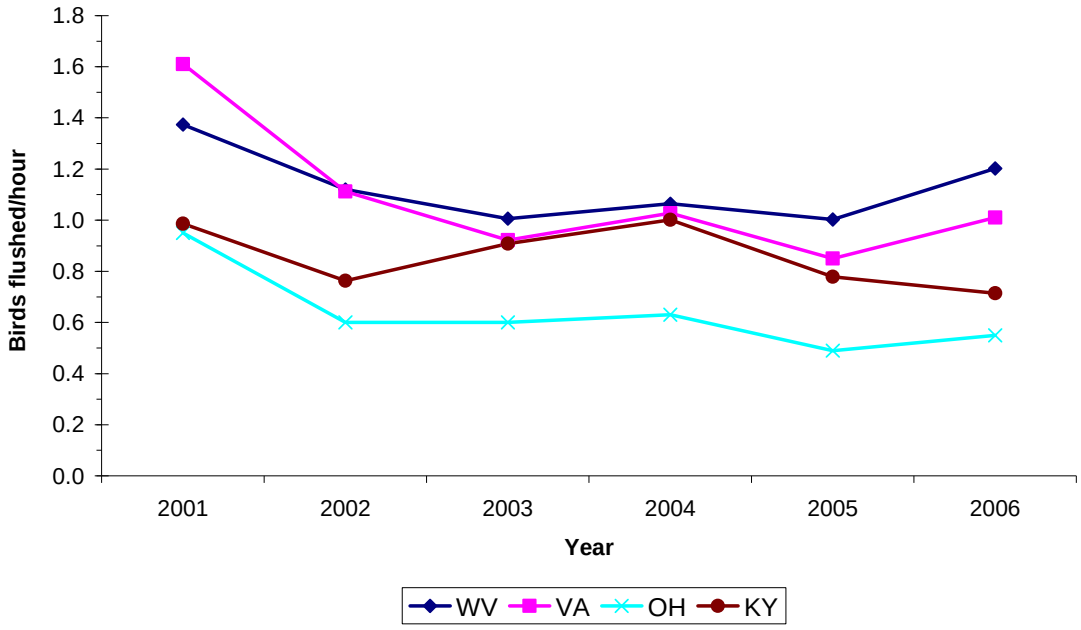

Figure 5. Regional ruffed grouse flushing rates.

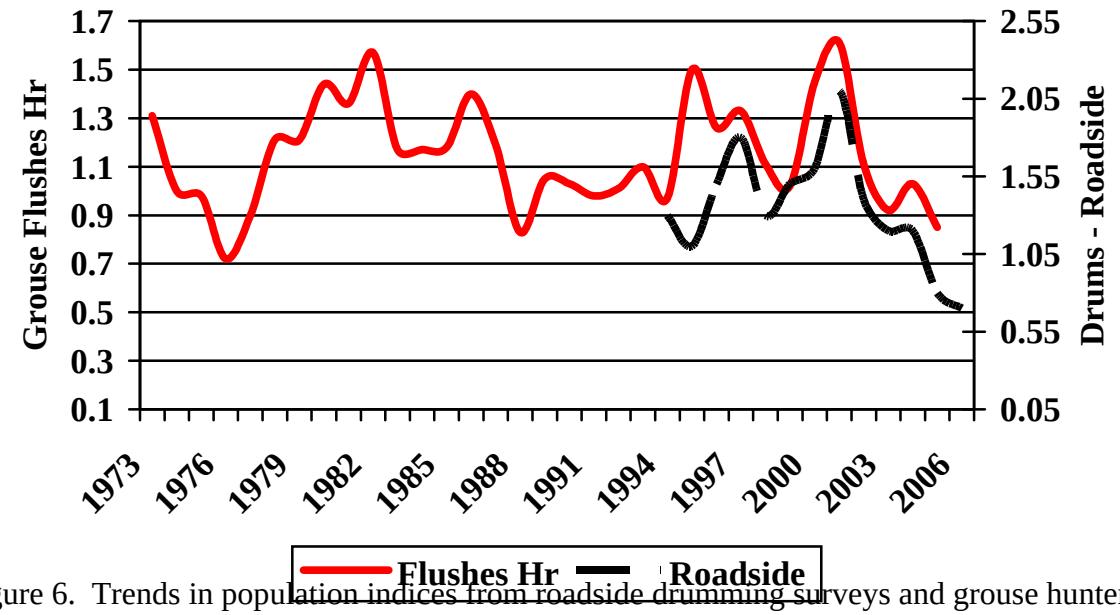

Figure 6. Trends in population indices from roadside drumming surveys and grouse hunter flushes per hour in Virginia.

Appendix A.

RUFFED GROUSE SURVEY

NAME: ______________________________

ADDRESS: ____________________________

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For further information contact Gary Norman at Virginia Department of Game and Inland Fisheries, P.O. Box 996, Verona, VA 24482 or call 540-248-9389.

INSTRUCTIONS:
Only one hunter per party needs to complete this form. Count every flush even if you believe it is the same bird. Count flushes whether you see the bird or not. All information regarding hunters and county information will be kept in confidence. Mail survey and feather samples as soon as possible after the season closes.

MONTH - DAY - YEAR	COUNTY	LAND TYPE *	HUNTERS IN PARTY	HOURS HUNTED	GROUSE FLUSHED	GROUSE KILLED	HUNT WITH DOG? (CHECK)	RATE QUALITY OF THIS HUNT (CHECK)	COMMENTS
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	
- -							YES ☐ NO ☐	POOR ☐ ☐ ADEQUATE ☐ ☐ ☐ EXCELLENT ☐ ☐	

LAND TYPE*
1. Private
2. State Owned (Game Dept. WMA, State Forest)
3. Federal Owned (National Forest)

Appendix B.

RUFFED GROUSE AND WILD TURKEY SURVEY

Virginia Department of Game and Inland Fisheries

ROUTE NUMBER

COUNTY

DATE OF SURVEY

YEAR MONTH DAY

OBSERVER'S NAME: (F. INITIAL, M. INITIAL, LAST)

MAILING

ADDRESS ZIP CODE

PHONE ( )

THIS IS THE ☐1ST ☐2ND RUN OF THIS ROUTE THIS YEAR

WAS THIS ROUTE RUN BY YOU LAST YEAR?

☐YES ☐NO

OFFICIAL SUNRISE : AM	SKY CONDITION	TEMPERATURE	WIND (See Back)	PRECIPITATION
ROUTE START TIME : AM	☐ CLEAR	°F °C	☐ CALM	☐ NONE
	☐ 1/4 OVERCAST	35-39 ☐ 2-4	☐ GENTLE (1-3 mph)	☐ MIST
	☐ 1/2 OVERCAST	40-49 ☐ 5-9	☐ LIGHT (4-7 mph)	☐ SNOW, HEAVY RAIN
	☐ 3/4 OVERCAST	50-59 ☐ 10-15	☐ MODERATE (8-12 mph)	☐ FOG
	☐ > 3/4 OVERCAST	60+ ☐ 16+	☐ STRONG (> 12 mph)	☐ LIGHT RAIN

STOP NUMBER	ODOMETER READING	TIME	TOTAL DRUMS IN 4 MINUTES	NO. INDIVIDUAL TURKEYS GOBBLING	DISTURBANCE (See Back) NO	LOW	MOD	HI	REMARKS
1	.								
2	.								
3	.								
4	.								
5	.								
6	.								
7	.								
8	.								
9	.								
10	.								
	TOTAL								

TOTAL STOPS	ACCEPTABLE STOPS	TOTAL DRUMS ON ACC. STOPS	NO. INDIVIDUAL TURKEYS GOBBLING	ROUTE STATUS

DO NOT WRITE IN SHADED AREAS

PLEASE READ INSTRUCTIONS ON REVERSE SIDE CAREFULLY AND COMPLETELY

Main points to consider are listed below:

(1) Conduct survey within dates specified.

(2) Begin route 30 minutes **BEFORE** sunrise. Sunrise times are listed on route map.

(3) Stops should be at 1 mile intervals. Listen for exactly 4 minutes at each stop.

(4) Do not conduct survey if temperature is below 40° F (5° C), in moderate wind (≥ 8 mph), or if persisting rain develops.

(5) Fill out **ALL SECTIONS** of this form and mail form.

Appendix B.

SURVEY INSTRUCTIONS

OBSERVER It is preferable that the same observer run the same route each year. When this is not possible, it is desirable for both observers (old and new) to run the survey together once, so that there is a smooth transition with the new observer becoming thoroughly familiar with survey procedures and local route conditions. Both observers should record their results independently.

DATES For 2001, the first run should be during the week of April 9-13; second run during April 16-20

TIME Begin 30 minutes before sunrise. Sunrise times for April 11, 13, 15, and 17 are listed on each route map. Interpolate sunrise time for dates not listed on the map.

PROCEDURE At stop No. 1 shut off your vehicle's engine, step several feet away and record the time you begin listening. Listen for 4 minutes and count total drums heard. Also determine the number of wild turkeys gobbling and record data. Then proceed rapidly 1 mile to the next stop and repeat the procedure. Continue to do so until all 10 stops have been covered. If a bad traffic hazard prevents stopping within 100 ft. of the 1 mile odometer reading, proceed to the next stop and note "no stop-hazardous" in the space for the stop omitted.

THINGS TO AVOID Do not run routes when the temperature is below 40° F, in heavy precipitation or moderate wind ($\geq$ 8 mph).

REPORTING Immediately after running your route for the second time, mail the forms in the envelopes provided.

ESTIMATING WIND VELOCITY

Velocity (mph)	Suggestions for Estimating Wind Velocity
Less than 1	Smoke rises vertically
1 to 3	Direction of wind shown by smoke drift, but not by wind vanes.
4 to 7	Wind felt on face, leaves rustle, ordinary wind vane moves.
8 to 12	Leaves and small twigs in constant motion; wind extends light flag.
13 to 18	Raises dust and loose paper; small branches are moved.

DISTURBANCE

Disturbance	Description	Example
NO	No appreciable effect on count.	Occasional crow calling.
LO	Slightly affecting count.	Distant tractor noise.
MOD	Moderately affecting count.	Intermittent traffic.
HI	Seriously affecting count.	Heavy-continuous traffic

g:wildlife/norman/grouse/survey instructions